

How do prairie strips influence soil health?

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Introduction

- Prairie strips alter key soil properties relevant to crop production:
 - Dense perennial root structures inhibit soil erosion¹ and promote accrual of soil organic carbon(SOC).²
 - Prairie strips serve as nitrate sinks² and filter neonicotinoid insecticides.³
- While physical and chemical changes to soil health have been explored, the biological mechanisms underpinning these processes are not well understood.
- Structure and function of soil microbial communities have been shown to shift during prairie establishment^{4,5}, and could be driving changes to soil health in prairie strips and surrounding cropland.

Here I outline a project initiated in Summer 2019 to investigate how prairie strips influence the dispersal and function of soil microbial communities at multiple stages of prairie strip establishment.

Questions

1. Can prairie strips facilitate the dispersal of bacteria and fungi to surrounding row crops?
2. How do prairie strips influence microbe-mediated nutrient cycling processes?

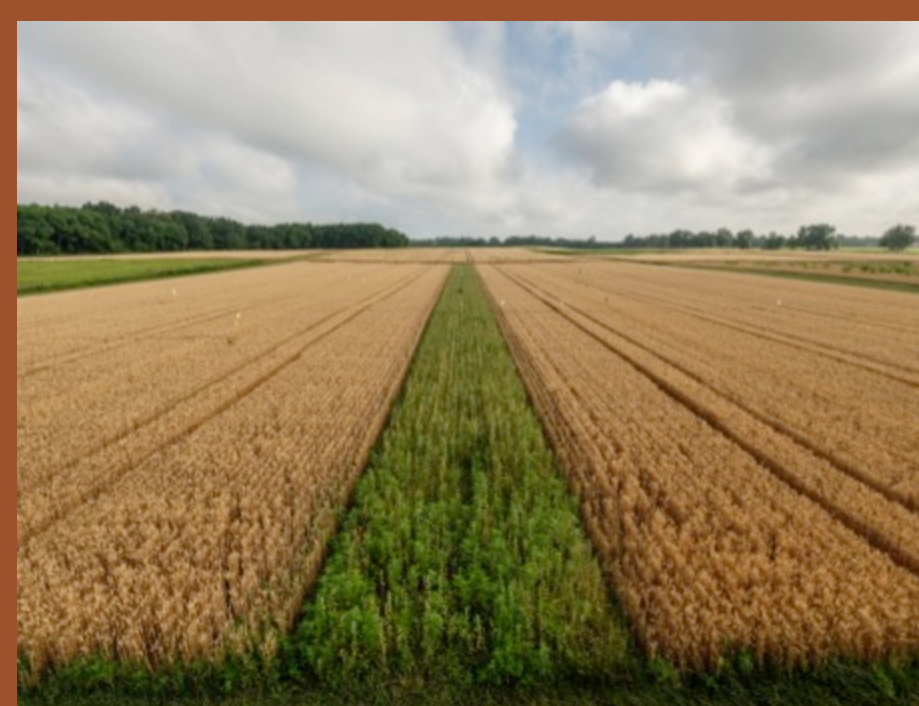


Figure 1. Newly established prairie strips at Kellogg Biological Station, 2019.
Photo: Kurt Stepnitz Photography



Figure 2. 11 year old prairie strips at Neal Smith National Wildlife refuge, 2019.
Photo: Iowa State University

References

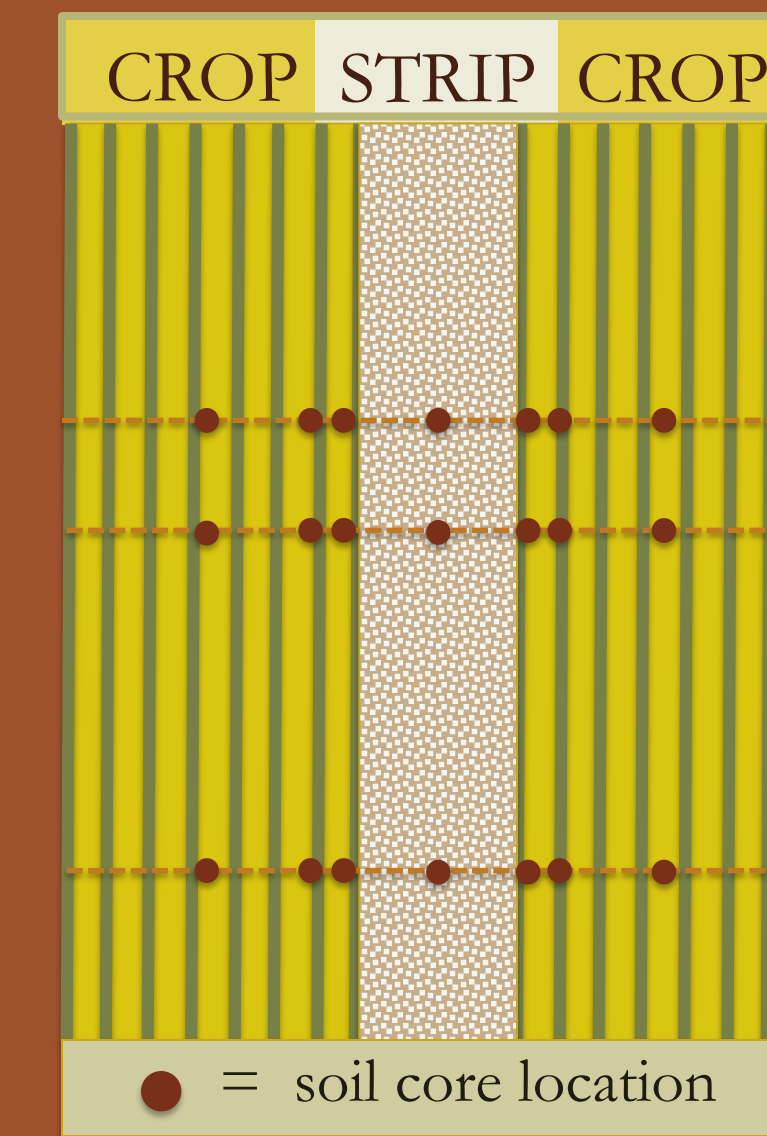
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Methods

Sample collection



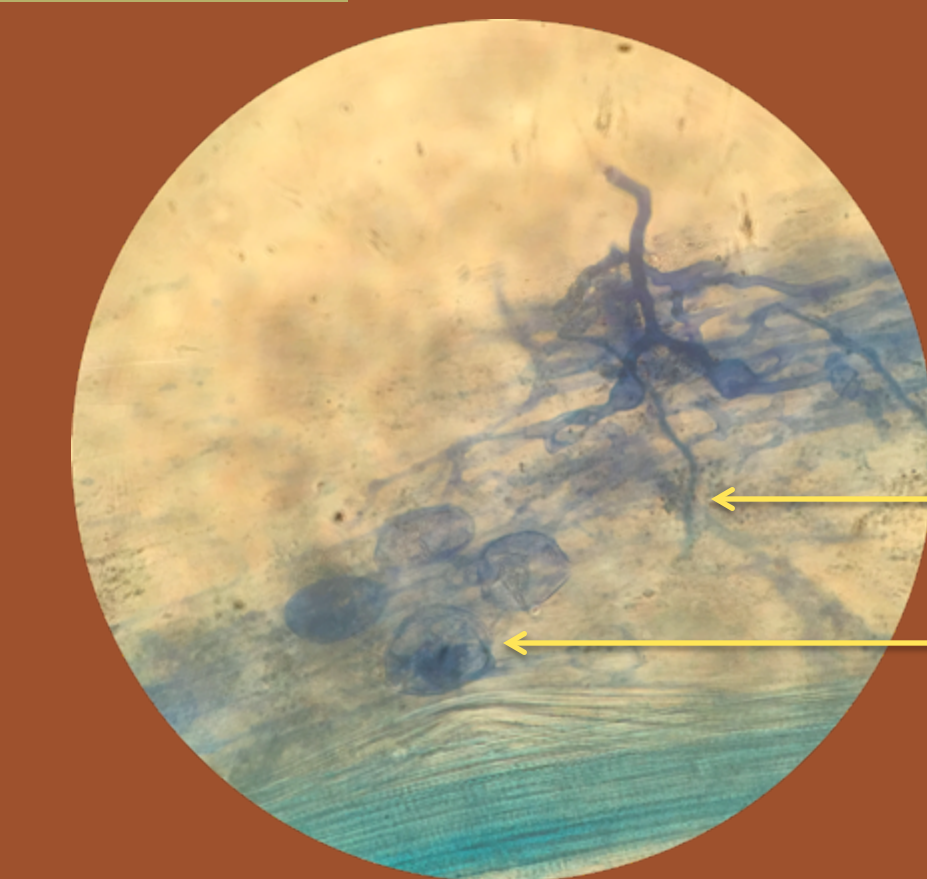
Sampling Site	Neal Smith National Wildlife Refuge	W.K. Kellogg Biological Station (KBS)
Location	Prairie City, Iowa	Hickory Corners, Michigan
Year of prairie strip establishment	2002	2019



Soil cores were collected along transects running perpendicular to each strip, extending from the center of the strip to the adjacent row crop field in each direction.

Data collection

Measurements
Arbuscular mycorrhizal fungi (AMF) colonization
Amplicon sequencing for bacterial and fungal community composition
Active C
Soil protein



Stained root tissue from KBS prairie strip soil (400x) containing AMF structures:

Hyphae

Vesicles

Next Steps

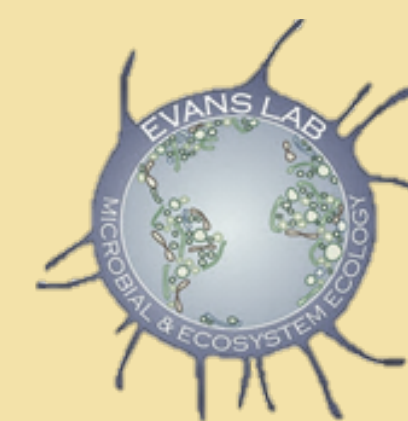
1. What mechanisms may facilitate the dispersal of bacteria and fungi from prairie strip to surrounding cropland?
Potential approaches:
 - Characterize air microbial community
 - Characterize hyphal sphere microbial community (on the surface of fungal hyphae)
 - Use stable isotope probing to trace microbial dispersal and carbon incorporation
2. How does the abundance of functional genes change with distance from prairie strip during establishment?
Potential approaches:
 - Use qPCR or GeoChip functional gene array to quantify genes associated with:
 - Insecticide degradation
 - N cycling
 - C cycling

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